

## CLAIMS

1. A method of improving a thermal stability for cobalt salicide, comprising:
  - providing a substrate having a silicon layer thereon;
  - forming a cobalt layer over the silicon layer;
  - forming a  $\text{TiN}_x$  layer over the cobalt layer;
  - performing a first thermal process to form a cobalt salicide layer over the silicon layer; and
  - removing a non-reactive cobalt layer,wherein the  $\text{TiN}_x$  layer includes x atoms of nitrogen for each atom of titanium in a  $\text{TiN}_x$  molecule, and a value of x is greater than 0.9.
2. The method of claim 1, further comprising:
  - performing a second thermal process,wherein the second thermal process is performed after the removing of the non-reactive cobalt layer.
3. The method of claim 1, wherein the  $\text{TiN}_x$  layer is formed by a sputtering process.
4. The method of claim 3, wherein a gas used in the sputtering process comprises  $\text{N}_2$  and Ar.
5. The method of claim 4, wherein a ratio of  $\text{N}_2$  to Ar in the gas used in the sputtering process is approximately 3:1.

6. The method of claim 1, wherein the  $\text{TiN}_x$  layer is formed to a thickness in a range of approximately 25 angstroms to approximately 100 angstroms.

7. A method of forming cobalt salicide, comprising:  
providing a layer of silicon;  
forming a layer of cobalt over the layer of silicon;  
forming a layer of  $\text{TiN}_x$  over the layer of cobalt, wherein a value of  $x$  is greater than 0.9; and  
performing a first thermal process to form a layer of cobalt salicide over the layer of silicon.

8. The method of claim 7, further comprising:  
removing a layer of non-reactive cobalt; and  
performing a second thermal process, the second thermal process being performed to decrease a resistance of cobalt salicide formed in the performing of the first thermal process.

9. The method of claim 7, wherein the forming of the layer of  $\text{TiN}_x$  is by a sputtering process.

10. The method of claim 9, wherein the sputtering process is accomplished with a gas comprised of  $\text{N}_2$  and Ar.

11. The method of claim 10, wherein the ratio of  $N_2$  to Ar in the gas comprised of  $N_2$  and Ar is approximately 3:1.
12. The method of claim 1, wherein the  $TiN_x$  layer is formed to a thickness in a range of approximately 25 angstroms to approximately 100 angstroms.
13. A method for forming cobalt salicide having improved thermal stability, comprising:
- providing a silicon layer, the silicon layer being one of a substrate formed of silicon and a layer of silicon formed over a substrate;
  - forming a cobalt layer over the silicon layer;
  - forming a  $TiN_x$  layer over the cobalt layer, wherein a value of x is greater than 0.9;
  - performing a first thermal process, the first thermal process reacting the cobalt layer to form a layer of cobalt salicide;
  - removing any unreacted cobalt; and
  - performing a second thermal process to reduce a resistance of cobalt salicide formed in the performing of the first thermal process.
14. The method of claim 13, wherein the  $TiN_x$  layer is formed over the cobalt layer by performing a sputtering process.
15. The method of claim 14, wherein the sputtering process is performed with a gas comprising  $N_2$  and Ar.

16. The method of claim 15 where the ratio of N<sub>2</sub> to Ar in the gas comprising N<sub>2</sub> and Ar is approximately 3:1.

17. The method of claim 13, wherein the TiN<sub>x</sub> layer is formed over the cobalt layer to a thickness in a range of approximately 25 angstroms to approximately 100 angstroms.